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**THE
ASSOCIATION OF
MATHEMATICS
TEACHERS OF
INDIA**

The Association of Mathematics Teachers of India (AMTI) was started in 1965 for the promotion of efforts to improve Mathematics education at all levels. A major aim of the Association is to assist practising teachers of Mathematics in schools in improving their expertise and professional skills. Another important aim is to spot out and foster Mathematical talents in the young. The Association also seeks to disseminate new trends in Mathematics education among parents and public. Other activities of the Association include consultancy services to schools in equipping the Mathematics section of their libraries, in organising children's Mathematics clubs and fairs, in setting up teacher centres in schools, in conducting Mathematics laboratory programmes, in holding practical tests in Mathematics in assisting children in participating investigational projects.

The Association holds "National Mathematical Talent Search Competition" annually and organises Orientation Courses, Seminars and Workshops for teachers and courses for talented students. A national conference is held annually in different parts of the country for teachers to meet and deliberate on important issues of Mathematics education. Innovative teacher award has been instituted to give public recognition to enterprising and pioneering teachers of Mathematics for which entries from teachers are invited.

An award for contributions to the Mathematics Teacher relating to History of Mathematics in the context of mathematics education has been instituted by Prof. R.C. Gupta.

"The Mathematics Teacher (India)" (MT) is the official quarterly journal of the Association and is issued twice a year. It has been approved for use in schools and colleges of education by the Government departments of education in many States. Besides MT the Association also brings out Junior Mathematician (JM), three issues in a year, especially for school students in English and Tamil.

The membership of the Association is open to all those interested in Mathematics and Mathematics Education. The membership fee inclusive of subscription for "The Mathematics Teacher (India)" and effective from April 1993 is as follows:

Subscription for India*

Category	Individual	Institutional
Life	Rs. 1000	Rs. 1500
Annual (Ordinary)	Rs. 100	---
Junior Mathematician – Life	Rs. 500	Rs. 500
Junior Mathematician – Annual	Rs. 50	Rs. 50

The Journal "The Mathematics Teacher" will be supplied free to all members.

Fifty or more subscriptions to Junior Mathematician will entail 20% discount.

*** For countries other than India same figures in US \$.**

(inclusive of postage)

i.e instead of rupees read US dollars

The Mathematics Teacher

(INDIA)

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Meghraj Bhatt
Editor

EDITORIAL

This is Vol.57 (3&4) of the Mathematics Teacher.

I request all the readers to write articles on various topics that are taught in the school syllabus. The articles may contain some new results based on the known theorems / results or may be on some problem solving techniques. They may be on some inspiring events from the life of a Mathematician or may be on some historical note. One can write on a problem which can be solved by different methods . Even one can write a review of some book that he/she has read.

In this issue, the “Problem Section” is given. Two problems are given to solve. They may not be difficult for Teachers but I request to encourage the students to solve. Detailed answers can be sent to me on my e-mail. Also there is another section “Mathematical News”. I hope , everybody will enjoy.

A moment of joy for all

After the successful launch of the Chandrayaan-3 mission on July 14, we all were eager to watch the success of soft landing of it on the surface of moon. And it happened! A great success by the scientists of the ISRO. On behalf of the “The MT”, hearty congratulations to all the scientists, technicians and the whole team involved in the task. As teachers (and also students) of Mathematics, we all feel proud of this grand achievement of our country!

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MULTI DIMENSIONAL APPROACH IN LEARNING MATHEMATICS

[Senior Secondary Level]

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Introduction:

Senior Secondary stage is a launching stage from where the students go either for higher academic education in subjects or for professional courses. Mathematics at this stage is a little more abstract as compared to the subject at secondary stage. In order to transact the subject in an effective manner, creating a friendly and co – operative climate in the classroom is a pre – requisite. Focus of the examination on rank ordering students tilts the classroom climate towards vicious competitiveness, to the exclusion of all other goals of education. Instead of the real quest for learning, fear of examination, malpractices, stresses and frustrations result from these competitions. Learning is to be a joyful experience. As teachers our role is crucial. Research shows that teachers' and parents' expectations affect the actual performance level. The differential abilities of students need to be recognized. All students may not excel in all subjects. But ensuring some amount of success for all students is necessary for motivating them to continue and strive for success.

Rationale:

Teaching students to solve problems in a mechanical manner to score well in examinations is usually the only goal at senior secondary level. There is no focus on changing knowledge, skills and attitudes of children. There is no importance to effective learning of concepts and the schools are now changed to concentration camps for entrance examinations.

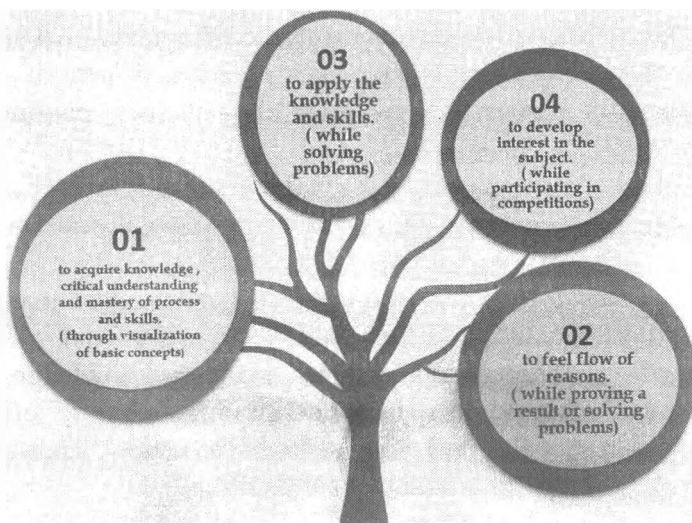
Broad Objectives of Mathematics Education:

Help the students -

- to acquire knowledge , critical understanding and mastery of process and skills.
(through visualization of basic concepts)
- to feel flow of reasons.
(while proving a result or solving problems)
- to apply the knowledge and skills.
(while solving problems)
- to develop interest in the subject.
(while participating in competitions)

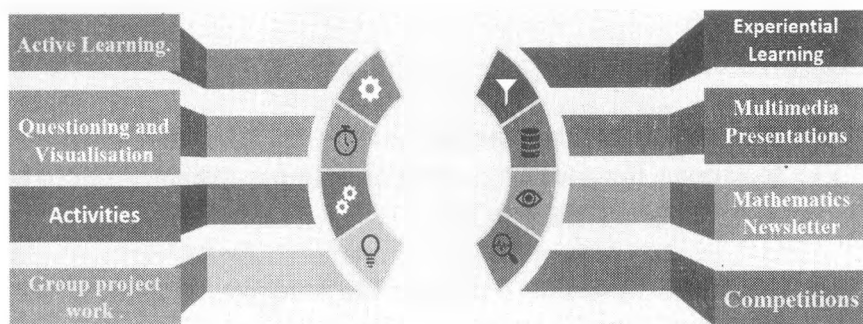
The general objective of this study is to promote an environment in which learning mathematics become easy, effective and enjoyable at senior secondary level. The specific

objective is to extend within the formal curriculum, basic life skills and competencies through the practice of recent developments in “Active Learning.” and “Experiential Learning” along with other strategies.



Strategies :

In fact, teachers complete the syllabus as per the textbook. But they do not have a clear idea about the kind of learning that takes place. The curricular expectation is not met many a time. Each teaching situation is unique in terms of objectives, content and environment. The teaching strategies, methods, media and tactics should be appropriately planned, keeping various factors in mind. Some of the strategies that can be successfully adopted in classrooms are given below.



a) Active Learning

Bonwell and Eison popularized the idea of “active learning” and discussed a variety of methodologies to promote the approach. To learn, students must do more than just listen. They must read, write, discuss or be engaged in solving problems. It relates to the three learning domains referred to as knowledge, skills and attitudes. Students must engage in higher thinking tasks such as analysis, synthesis and evaluation. Active learning engages

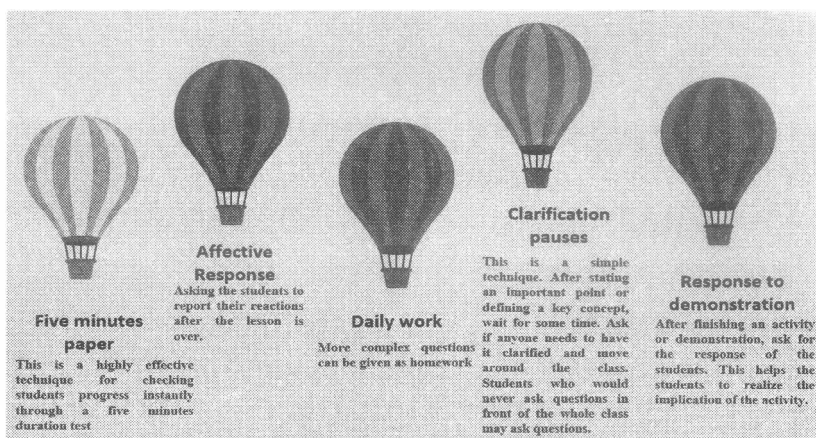
the students in two aspects - doing things and thinking about things they are doing. Learners work collaboratively, discuss materials, debate and take part in co-operative learning. In an active learning environment learners are immersed in experiences, while engaged

in enquiry, action, imagination, invention, interaction, hypothesizing and personal reflection.

Active Learning practice gives students a few minutes to work with the information provided. Opportunities are provided to clarify, apply and consolidate new knowledge. Student attention begins to decline after 10 to 15 minutes of a lecture. But active learning techniques help in making learning effective and meaningful throughout the period.

Steps in Active Learning

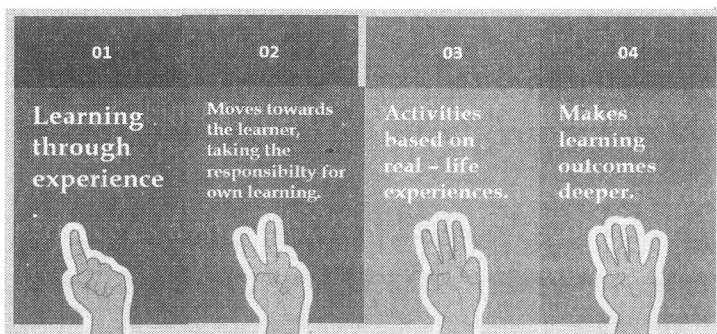
- 1) The “Five minutes paper” – this is a highly effective technique for checking students progress instantly through a five minutes duration test.
- 2) Affective Response – asking the students to report their reactions after the lesson is over.
- 3) Daily work – More complex questions can be given as homework.
- 4) Clarification pauses – This is a simple technique. After stating an important point or defining a key concept, wait for some time. Ask if anyone needs to have it clarified and move around the class. Students who would never ask questions in front of the whole class may ask questions.
- 5) Response to demonstration – After finishing an activity or demonstration, ask for the response of the students. This helps the students to realize the implication of the activity.



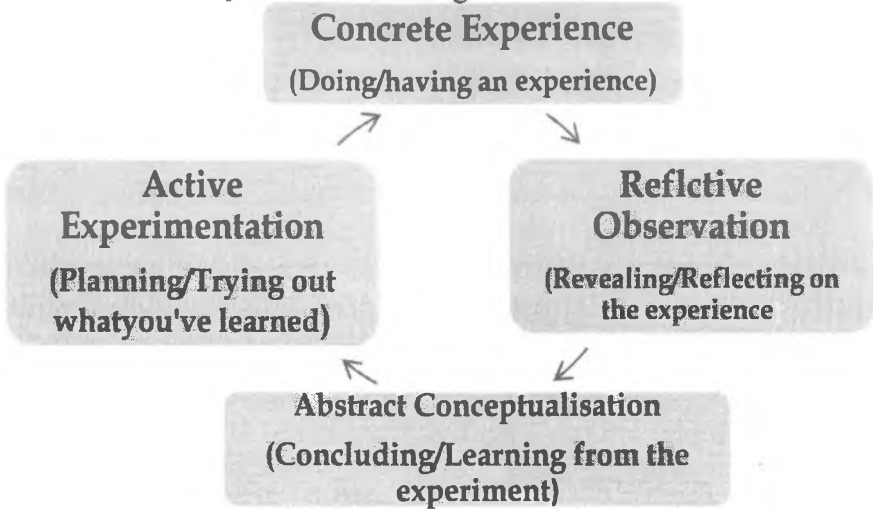
b) Experiential Learning

This is the process of learning through experience. Experiential learning moves towards the learner taking the responsibility for own learning, with the help of activities based on real – life experiences. This way of learning makes learning outcomes deeper. Experiential learning includes all these –

- Joyful learning
- Art integrated learning
- Activity based learning
- Inquiry based learning
- Collaborative learning
- Learning by doing



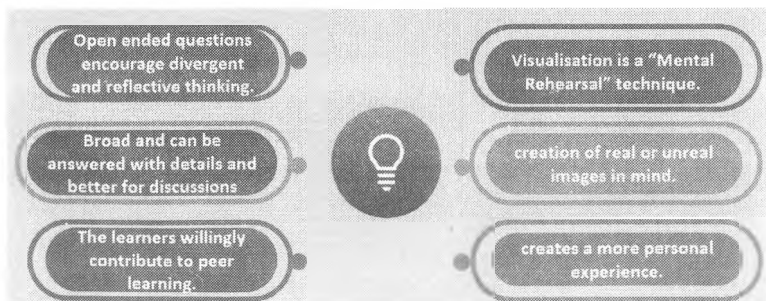
David Kolb's Experiential Learning Model.



c) Questioning and Visualisation

Open ended questions encourage divergent and reflective thinking. The learners willingly contribute to peer learning. Open ended questions are broad and can be answered with details and better for discussions and enquiries.

Visualisation is a “Mental Rehearsal” technique. It involves the creation of real or unreal images in mind. Visualisation and visual reasoning play vital roles in Mathematical thinking. Algebraic equations can be visualized through graphs using “Geogebra” and “Math GV” Visualisation creates a more personal experience.



d) Multimedia Presentations

Presentations through multimedia [PPT] help in visualization of abstract concepts in Mathematics.

e) Activities with low cost / no cost aids

Low cost/ no cost teaching aids can be used for demonstration in class room and performing prescribed lab activities.

f) Mathematicians and Contributions

Group project work on Indian Mathematicians and their contributions can be given after forming separate groups in the whole class. This will develop reverence towards our great Mathematicians and creates interest in the subject.

g) Mathematics Newsletter

A Mathematics News letter covering current developments and History of Mathematics can be released periodically in every month with the assistance of students. Also, information can be provided about careers in mathematics in the newsletter.

h) Participation in Competitions

Encourage all the students irrespective of their performance in the subject to participate in Mathematics related competitions.

Outcomes and Educational Implications

The desirable outcome of the above multi dimensional strategy is to make students ready for future armed with learning, literacy and life skills.

1st century skills:

Learning skills	Literacy skills	Life skills
Critical thinking	Information	Flexibility
Creativity	Media	Leadership
Collaboration	Technology	Initiative
Communication		Social

The following are the indicators of expected outcome.

- Positive changes in the attitudes, knowledge and skills of children.
- An environment to enjoy learning Mathematics and to make learning process meaningful.
- Foundation for better academic achievements in future.

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PROBLEM POSING AND PROBLEM SOLVING ABILITY OF STUDENTS IN A CLASS

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Abstract:

Human beings are intuitively curious by nature. This has helped mankind to succeed at various levels right from the discovery of fire, to the invention of wheel. We question and observe our surrounding with an ambition to understand it better. To develop such an art of posing correct problem and search for solution remains the heart of ever developing and progressing human society. This study aims to understand the effect of class composition on the ability of problem posing and problem solving by students in mathematics. Although, the problem solving remained of general interest and problem posing has also been considered of importance. A single mathematical problem posed in a class could receive different solution based on student's interest level creativity and grasping ability. However, the churning of questions between different intellect level students in a class could be a key task to be attained by the teacher in real time scenario. A specific mathematical problem posed among students has to be appropriately funnelled. This leads to development of a system among students as such to talk out various alternative forms of the questions itself and to ultimately reach to the solution of a problem. In the present work we examine three such methods: (i) clustering high intellect student together and low intellectual together (ii) approximate mixing of student's intellect in a class from high, average to low and (iii) posing a general discussion among students in the class.

1. Introduction

A 'problem' is anything that involve doubt, uncertainty, or difficulty. Problem- based learning seeks to engage students in thinking through ill-structured realistic problematic situations found within the curriculum (Barell,2003). To solve a problem creativity in mathematics it is assumed that the teacher poses mathematical problems, asks higher order and reflective questions, encourages groups and whole class discussion, and provides opportunities to observe and explore mathematical relationship (Aiken 1973). Questioning is one of the thinking processing skill which is structurally embedded in the thinking operation of critical thinking, creative thinking, and problems solving. Moreover student's questions play on important role in the learning process as they are a potential resource for both teaching and learning science (Cuccio-Schirripa et. al., 2010). Though, the major importance has been given to problem solving attitude in mathematics, problem posing has attracted a great deal of concern. Thus, in mathematics problem posing and problem solving has remained a subject of wide scale discussion.

Is it really possible with the conventional learning approach used in the classroom? Conventional teaching techniques entail a teaching method involving instructors and the students. The instructor initiates discussions in the classroom, and focus exclusively on knowing content in textbooks and notes. Students receive the information passively and reiterate the information memorized in the exams. Many teachers do still follow their own techniques and how their own teachers were taught, not much of progress in terms of the teaching perspectives. Also class dynamics has been evaded in this process. In a modern day classroom we have student from diverse background, with different levels of intellect, social background has having diverse level of mindset.

According to the report of British Columbia ministry of education, honoring diversity in a class is based on the principle that diversity when acknowledge and utilized in a positive way; it is a benefit to

the quality of the teaching and learning environment for everyone. For education sector this implies that when whole class is included into problem solving it results in different approaches to the same problem. Looking the same problem from different point views also result in understanding the problem. The problems solving in such class could lead to intellectual health of the classroom and discipline in study (Herzig, Abee. H., 2005). There are three significant principal of learning of children from an individual prospective usually: 1) children learn in variety of ways and at a variety of rates, 2) they learn as individual and in groups and 3 they learn best when active in discussion.

In the present work be investigate effect of class composition to get the problem understood simultaneous tapping the creative potential of the students and leading overall development of the classes. In this study we discuss three such methods. This study aims to understand the effect of class composition on the ability of problem posing and problem solving by students in mathematics from daily life classroom experiences of a class teacher. A single mathematical problem posed in a class could receive different solution based on student's interest level, creativity and grasping ability. This leads to development of a system among students as such to talk out various alternative forms of the question itself and to ultimately reach to the solution of the problem. In the present work we examine three such method: (i) clustering high intellect students together and low intellectuals together (ii) appropriate mixing of student's intellect in a class from high , average to low and(iii)posing a general discussion among student in the class.

2. Methodology:

In this section, we discuss the common class room experiences obtained from a class room when using the different composition of disclaimer intellect students when undergoing mixing or grouping. In addition, it describes how teacher as a facilitator could develop a system of problem posing and problem solving in

mathematics in a classroom among student having separate levels of understanding.

2.1 Grouping students in the classroom on the basis of intellect

when creating group composition the choice of a student, the group dynamics the size of the group and the confidence of the teachers are among other important consideration. In the present study we mainly focus on using class diversity to develop a system which leads to more productivity in term of problem solving and problem posing of the students. There are three such ways in which the class composition could be varied to obtain maximum output:

- (i) Clustering high intellect students together and low intellect student together (homogenous groups)
- (ii) Approximate mixing of students intellect in a class from high to low (heterogeneous groups)
- (iii) Posing a general discussion in a class. It is believed that putting high intellect students together

i.e. forming a homogeneous group of high intellect student can improve educational outcomes. On the other handsome believe that clustering low internet student with high intellect students i.e. forming a heterogeneous group in beneficial.

- (i) Clustering high intellect student together and low intellect student together

When student with high intellect are grouped together they derive working habits and ideas from each others. Together they present best from of the information available and include their part into the piece of information with combined discussion which improves quality of work and knowledge of the students. The habit of practising methods to work a problem together providing them different approach to solve the same problem. This is called as the enhanced learning skills. Individually when such student attempt a problem they explore all the possibility of presenting the

information. If high intellectual students are further divided into sub-group they practise to outsmart the other high intellect groups which focus more on the developed of the student. The role of the teacher at such place would be made the groups maintain your healthy relation outside competition while helping each other to excel and exceed each other when given group task. Those in case of homogeneous group of high intellect students it is more likely that all the students will be benefited provided that the ideas of all the students are encouraged and accepted positively.

While in case of homogeneous group of low intellect students the possibility of academic growth is quite less but there is a probability that working with the students of the same intellect will help students absorb the subject knowledge and engross in subject. The subject interest could enable to develop the habit of understanding but a teacher must be vigilant to ensure the work on the ability of such group in problem solving. The problem solving approach could be hindered by making such students experience different from their daily life expected. The most appreciable method could be to perform an experimental base which provides the basic of imagination to such group of students. In homogeneous groupings, however, new leadership structures can be formed and student who never had to participate before may be forced to take on more active roles within the group. However, clustering high intellects student's together and low intellect student together will help them to stay on the same face as their classmates.

(ii) Appropriate mixing of students intellect in a class from high to low

Clustering students of different intellect together allow them to learn from each other differences and activities interact with deserved individuals, while at the same time sharing the unique ability and interest. During the sharing of information between high and low intellect students, it has been observed that the students acquire important trains from the other group. For

example short techniques to solve the problems, as this required more practice and explanation. Now days to learn the some problem while discussing and multiple methods to remember the same in always suitable. Discussing the questions that requires higher level of understanding.

One major drawback in this method comes from willingness of the high intellect or the low intellect student to pair with the different intellect student. Majority of the time of student become unwilling to pair up with high intellect student not of the same kind. Since the low intellect student in this case is of prime interest, this drawback could be counter by favouring the willingness of the low intellect student. While mixing the intellects in the class it is to be ensured that the both kinds of students are comfortable in learning and in teaching. This methods of teaching, different from the conversional class room, ensures the development of both students and teacher involved. For the high intellect students, learning in this kind of class room works as practise of knowledge and tailoring the information acquired in the desired format, student friendly format. Additionally, it serves the interest of the teacher in passing the required set of information to low intellect students. After certain discussion of mixed group a teacher could hinder the class by asking question those involve higher of thinking.

The class is a dynamic environment and working with students with different intellect is a challenge for the teacher. Being an effective teacher therefore requires implementation of creative and innovative teaching strategies to meet the individual needs of students. In such situation, co-operative learning work well. It will encourage students with mixed abilities to work together and enhance their ability. It will help in developing self confidence, communication skill critical thinking skills and problem solving skills in students.

(iii)Posing a general discussion in a class.

The third method is posing a discussion open for the entire class room to participate in. A group discussion involves active participation from each student in the class. The prospective listening from the speaker's point of view and then contradicting on inexplicit details. The general discussion on the relevant topic might appear easier for the teacher to subjugate the various levels of intellect of the student. However it requires first establishing proper ground rules by the teacher itself, preparing the class, to participate in the discussion. To have a group discussion in a class it is very important to have a clear subject of discussion in mind. It is the role of teacher to concisely convey the topic to the student. Establishing ground rules for participating; in effective discussion firstly the student need to understand

- (1) value for active listening
- (2) tolerating opposite view points
- (3) keeping an open mind towards the views
- (4) important of staying focused and
- (5) expressing themselves clearly.

In case of heated debate it is teacher's responsibility to diffuse the discussion with calm remark and bring the discussion back on track.

It is generally observed that high intellect students with comprise 10% - 20% of the classroom or always the foremost to speak on an open floor. This is the indicator of the level of confidence of the individual in the class and spontaneity on a given topic. Speaking completely depend on the ability of the student to present the information using apt vocabulary, spontaneity of the process rely on the information base. This is the group of students feeling worthy with a desire to prove their presence on the topic under discussion. When given an opportunity even the low intellect students filling more than 50-60% of the modern day classroom, having less confidence, could also speak but with proper

motivation, guidance of the teacher and fellow class mates within the class room. Most importantly the class room has to instil tools within the individual to remove the hesitation and fear of speaking from the Student. This fear of speaking and discouragement comes from the fellow student, sometimes from the personal life. The class environment remains the major cause of not participating in a discussion of the student. Lastly, the moderate intellect students, forming approximately 30% -40% of the classroom; participation depends on the willingness to participate in the discussion. Majority of the time they refrain to actively become part of such form of learning, it is complete responsibility of the teacher to stir the level of interest in them on subject discussion.

Conclusion

The study aims to understand the effect of class composition on the ability of problem posing and problem solving by student in mathematics in class. It is clear from above discussion that if the propose of group learning is to help the struggling students, the focus should be given on clubbing high intellect with low intellect and if the propose is to encourage the medium abilities group to learn at high levels homogeneous grouping will be better. Also, mixing the students intellect in a class makes it possible to overcome the diversified background of each individual to participate in overall progress of the entire class room. Apart from this, three things are also coherent from above discussion that in a class room the environment should be supportive to participate; secondly a teacher has to constantly monitor the participation of different intellect student present in the class, thirdly low intellect students should be aided with necessary boost in participate.

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Teaching & Learning Mathematics through online classes – Advantages and Disadvantages

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Online learning has become more accessible in the past decade as potential students discover that they can find ways to obtain a preferred degree while handling their daily obligations. It is a way that encourages post-graduate learning while staying within life and career schedules. Most accredited colleges and universities are now offering programs that make it possible to take some, if not all, of the required courses on the Internet.

Public and private institutions offer online classes more today than ever before in history. This education format is a way to reach students who may have social or economic situations that don't allow them to enjoy the traditional on-campus learning lifestyle.

As more people have access to high-speed Internet connections, online education opportunities have continued expanding. It has become acceptable in most circles to earn a degree at any level with these opportunities, allowing students to have legitimacy and more accessibility with what they earned.

The advantages and disadvantages of online classes continue to evolve, but these are the current key points to consider if you're thinking about becoming a student.

List of the Advantages of Online Classes

1. Online classes provide more flexibility to incorporate multiple learning styles.

Although you can earn a healthy salary without going to college in some trades, many employment opportunities require an undergraduate degree or higher to obtain a position. That means it can be challenging to get through classes when your learning style might be different than what a local institution offers.

Taking an online class allows you to have more control over how you retain the available information.

You can listen to music while you are writing a paper. Online classes let you interact in forums while watching television. Instead of being stuck in a stuffy classroom listening to a lecture, you have the flexibility to learn using the style that works best for your needs.

2. Your classes can fit better into your schedule.

Online classes are the perfect solution for anyone who works a full-time job, has a family to raise, is housebound for some reason, or lives in a rural area. These obstacles can make it challenging to enrol in a traditional institution. As long as you have an Internet or data connection, then you can access your study materials whenever you need them. Many professors are even uploading lectures or providing texts that supplement the learning process.

If you have a busy lifestyle and want to get ahead in your career, then learning at your own pace with an online class is an intelligent way to obtain your next college or university degree.

3. It takes advantage of technology innovations.

Online classes at many institutions take advantage of the technological innovations that occur every year. These changes get applied in convenient and practical ways, such as the implementation of a rolling semester. Some colleges and universities make their courses dominant from an independent standpoint, making it possible for students to complete their curriculum based on a schedule they said instead of what the professor requires.

As more degree programs become 100% online opportunities, many colleges and universities are finding that the independent and innovative approach makes it easier for modern students to achieve their goals.

4. Online classes are typically cheaper than traditional enrolment.

Students that take online classes find that the cost of their college degree is usually less expensive than it would be if they took courses on campus. There are usually fewer textbook purchases to consider, travel cost reductions, and room and board considerations that can cut the cost of a college or university degree by 50% or more. That means each person who uses this opportunity can start their career with lower debt levels.

5. It teaches students how to be disciplined and responsible.

If you can access the Internet, then your online course work is immediately available. That means each student must have the discipline to maintain the continuity of their schedule while keeping themselves on track for a successful outcome. The freedom that comes with classes that you take online comes with the need to have higher levels of responsibility. Students must stay organized and adhere to a workable schedule.

Putting all of your time to the completion of an online degree can backfire if you neglect the other critical areas of your life. Take advantage of the flexibility that this option provides so that you can spend some time with your family members and friends.

6. You can receive a degree from an accredited institution.

A degree that you earn online from an accredited institution has the same weight in today's career marketplace as one earned from the traditional approach. That means your credentials and applications will get taken seriously when you are ready to pursue new career opportunities. This advantage also means that you can take the credits earned to other programs, pursue graduate-level courses, or go after that doctorate degree that you've always wanted.

7. Online classes offer location independence.

Some students may not have access to the program that best fits their needs. It might be across town from them, in another state, or even on the other side of the world. The availability of online classes makes it possible for students to participate in and graduate from their preferred program with less difficulty.

These programs do not generally have the same geographic restrictions that you'd find with a traditional institution.

Since moving isn't an option for many of today's students, especially adult learners who have career and family responsibilities, online classes allow each person to enroll in the program that's right for them regardless of where they live.

8. It provides students with real-life career preparation opportunities.

When students go to college, then it can feel like you're living in a bubble. You receive the necessary and valuable information that will let you establish a career one day, but it is not always easy to start developing the practical skills necessary to become good at your future job. Online classes require the same skill sets that many people use every day when working, which means you can enter a job market better prepared for what to expect.

An online class is quite similar to a desk job at almost any company. You must stay in touch through email, manage software solutions, and keep track of your time to ensure that you're fulfilling all of your obligations. You get tasked with remote work while still engaging with a team to complete projects before a deadline.

9. You form social connections with your classmates.

Although it is more difficult to make social connections with an online class, it isn't an impossible circumstance. Today's technology makes it possible to form relationships that go beyond sitting behind a computer. Your digital classmates could organize a group video hangout, facilitate conversations, and even do icebreakers that help everyone get to know each other better.

It may not be exactly the same as a face-to-face connection, but technology makes it very close. Video calls and other tools can help you to see each other even if you live on the other side of the planet.

10. It eliminates the need for verbal expression in a classroom environment.

Many online students find that it is easier for them to express their opinions in this structure because there isn't a public speaking component to the education process. You don't need

to worry about a professor calling you up to the front of the classroom to explain a concept or create a diagram. You can express yourself through writing instead, which means if something can get fixed if it doesn't sound right in the first draft.

This advantage often leads to high-quality dialogs where each learner can carefully reflect the quality of their thinking on each comment, chapter, or project. Then you can move on to the next one whenever you feel like you're ready.

11. Online classes create more opportunities for a varied learning experience.

An online course makes it easier to include guest experts or past students in the classroom environment. Even people from other institutions can get involved in the conversations that take place to facilitate the learning process. Students can receive exposure to a worldwide perspective in their preferred subject instead of being limited to the local point of view. That means the experience has more value to potential employers in the future.

12. Online math learning can make math more fun for early learners.

Math is often seen as a difficult and boring subject by kids, but it doesn't have to be! With a little creativity, online math learning can be fun and engaging. There are hardly any kids who have Math as their favorite subject as it can be quite daunting, especially in K5 learning. Many adults share experiencing nightmares of failing their math exams even long after school. Some even use fear before the math exam or its results as a reference for different life situations. That is the scare math children experience from a very young age.

However, there are ways to make the subject more interesting for them and less scary.

13. Tutors can utilize helpful online software.

Putting together and maintaining a classroom with well-functioning computers or laptops for each student is not an easy feat for a secondary school institution. With online teaching, tutors can usually be assured that their students each have access to a personal computer. They can thus rely on digital teaching tools, platforms such as Class In, and online resources without being as limited by the traditional school's financial and logistical constraints.

14. Some forms of testing can be made more efficient.

Tutors can save time by automatizing the marking of multiple choice tests – without needing to spend time supervising in-class examinations. (Electronic means of testing and homework submission also usually means that less paper is used in the process).

List of the Disadvantages of Online Classes

1. It can take longer to earn a degree when using online classes.

If a student is not thoroughly committed to earning their degree, then it can take several years for that person to complete their online classes. Everything that the course requires is up to you. That means you must complete your assignments, read the required materials, interact with your professor, talk with your peers, and take exams according to the rules presented upon enrolment. It can be tempting to ignore your obligations when there isn't a direct line of accountability as there is when you attend a physical classroom.

2. Some of your required course work might require in-person activities.

If you are taking online classes, then there may be some stipulations where you must attend classes or take tests in a proctored environment. If a third-party observer is necessary, then it is up to each student to find an organization that will monitor this process. That means the cost of your classes each semester will go up based on the number of exams you must take.

Some institutions will even require a specific amount of on-campus time before they will award a degree. This requirement can last anywhere from two weeks to two months for U.S.-based colleges and universities.

3. You still need to take the time to fulfil your classroom requirements.

Online classes can help students save a lot of time on their learning obligations, but the structure will not eliminate the need to put in some work. If you do not have a lot of free time during the day, then it may be impossible to fulfil the obligations of your enrolment. That's why the flexibility of this arrangement can be an advantage since you only need to take one class at a time – but that can still be problematic for some people.

It is possible to avoid some of this disadvantage by taking independent learning courses online. When you can complete the work at your own pace, then the pressure of deadlines can disappear. You must still have trust in the program and remain dedicated to a result to turn this education opportunity into a real investment for you.

4. Online classes don't provide the same face-to-face connections.

Colleges and universities provide numerous opportunities for in-person social networking. When you can have face-to-face conversations with your professors and peers, then it can enhance the educational foundations that you receive.

Networking functions can serve as essential connections for future career opportunities. The structure of online classes negates many of those potential advantages.

Even though you might have an institution that focuses on small class sizes and curriculum requirements that mandate interaction, a forum conversation or online chat isn't the same as sharing coffee or lunch with someone.

5. Some online institutions don't have full accreditation.

You must verify that the college or university providing the online classes you want has full accreditation. Many facilities are not accredited even with the expansion of Internet access. That means your degree and qualifications might not receive the recognition you expect from potential employers. It may not receive serious consideration from other professionals in your preferred industry. This disadvantage also means that any credits earned might not be transferable to another institution.

The outcome of this disadvantage can be a costly mistake in terms of time and money. You'll want to make sure to verify the specific accreditation of any school you're considering before you even turn in an application.

6. You must have access to the Internet to complete your work.

Online classes require you to have access to the Internet so that you can complete your assignments on time. If you don't have the equipment at home to do the work or a connection that is

fast enough to handle your course work, then it may be challenging to have a successful experience with this learning option.

You'll need a computer or tablet PC, a home-based ISP, and any peripherals necessary for your degree program.

Some public libraries and other institutions may offer computer access, but it may come with limited time or additional costs. You would also need to access that equipment during their regular working hours, which may not be possible with your specific schedule.

7. Many online classes require students to complete more work.

The average online course in the United States requires a greater amount of reading and student interaction than a traditional class. Students must prove remotely that they have mastery over the material in question, which means your curriculum will involve a lot of independent study and Internet-based group work. Although the average amount of time one needs to dedicate to their course work is about 10 hours per week for each class, it is not unusual for individual courses at accredited colleges and universities to require 15-20 hours per week of work.

8. Technology scheduling issues can limit learning opportunities.

Students must ensure that their computer is updated frequently with the latest operating system and software components to facilitate their learning. Some people may need to learn new or enhanced troubleshooting skills to manage their boot-up time, Internet connection, or software platforms that a professor requires. If you are a person who considers themselves to be technically challenged, then the tasks of this disadvantage could be a significant barrier to your current and future learning opportunities.

9. Time variations could be problematic for some students.

Students who take online classes must plan and adjust their schedules to meet the deadlines set by their professors. American institutions often base deadlines on the time zone of the institution, so a West Coast student would need to account for the three-hour difference for an East Coast deadline. If international students are taking online courses, then this disadvantage could be significant.

This issue becomes problematic for students with opposite schedules. If you study at night and your partner works during the day, then there will be significant lag time between each response.

Conclusion

If you have a hectic schedule or zero access to a college or university, then online classes are a way to pursue your academic goals. It only requires Internet access or a data connection, and then you can begin fulfilling the requirements of your course work.

The modern structure of this learning opportunity does an excellent job of simulating the traditional classroom experience. This option may not be a first-choice selection for someone who struggles with their organization or focus. If you're already putting in 40 hours each week with your job, then it may be unreasonable to put in another 20-40 hours after you get home to fulfil your learning obligations. These advantages and disadvantages of online classes must receive individualized consideration. If you live at home full-time and want a self- directed education, then this innovation can be a positive experience. When you prefer social interactions and a traditional classroom, then it may not be the best choice to pursue.

ELLIPSE FORMULAS – Paul’s Method

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1. Introduction

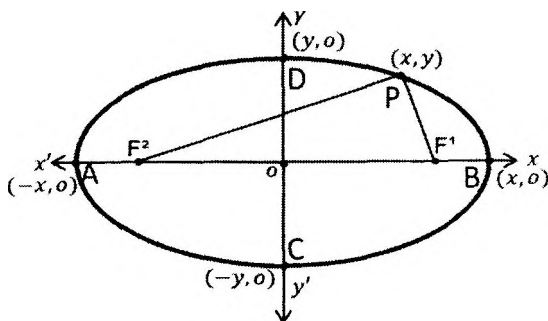
1.1. Ellipse

There are already several definitions to describe an ellipse. An ellipse is taught to be a plane curve surrounding two focal points, such that for all points on the curve, the sum of the two distances to the focal points is constant. The sum of the focal distances of any point on the ellipse is equal to the length of the major axis. Also, an ellipse is an inclined plane of conic cross-section. Basically, an ellipse calculations are based on two-dimensional quantities and its basic equation is $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. The elongation of an ellipse is denoted by its eccentricity, a fraction number between 0 and 1. Although accurate results can be obtained from these calculations, so far there are no common formulas for calculating the chord lengths, tangents, etc. of an ellipse yet.

1.2. Some conventional diagrams about the ellipse;

Figure 1.1: Ellipse

$$(F^2P + F^1P = F^2D + F^1D = F^2B + F^1B = AB)$$



34

1.3. New Method

This new method sees the ellipse as an oblique cross-section of a cylinder from a different perspective. Any oblique cross-section of a cylinder is an ellipse. The ellipse seen in the cross-section of a cylinder elongation depends upon the oblique angle of the cross-section from the flat (base) cross-section. It can be assumed that the slope determines the elongation of a circle to an ellipse. This method helps to find all the dimensions of an ellipse through trigonometric calculation and to develop common formulas for finding the dimensions of ellipses. If we know any two of the dimensions of the inclination angle, the length of the major axis and the length of the minor axis, we can find all the other dimensions of that ellipse.

Figure 1.4: Cylinder oblique cross-section

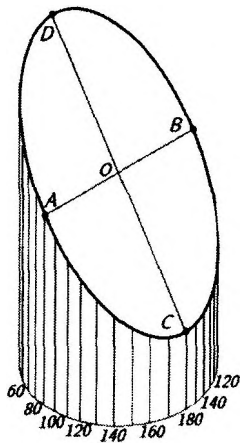
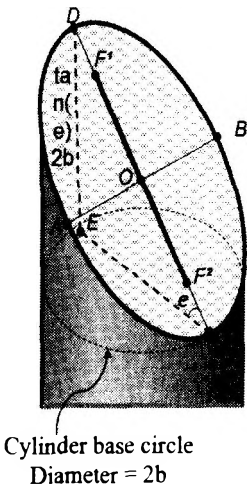


Figure 1.5: Cylinder oblique cross-section



2. Reason for choosing cylinder oblique cross-section as an ellipse

2.1. Cylinder and Circle

2.1.1. A cylinder is a three dimensional shape with long straight sides and two circular ends of equal size.

Figure2.1: Cylinder

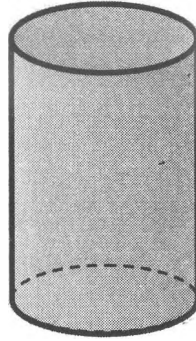
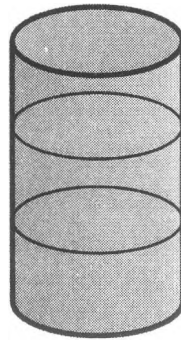


Figure2.2: Cylinder

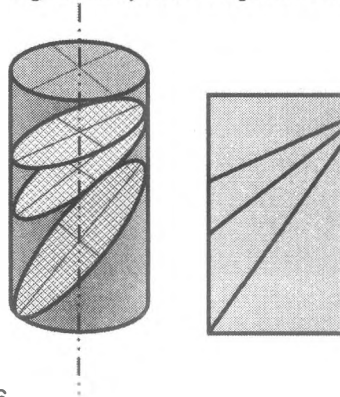
2.1.2. The exact cross-section of the cylinder at any point is a circle.



2.2. Cylinder and Ellipse

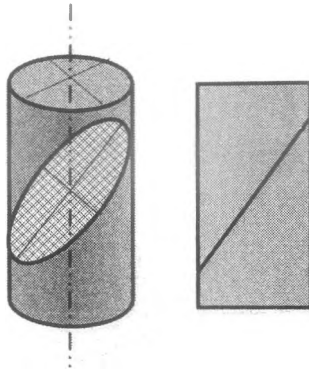
2.2.1. Any oblique cross-section of a cylinder is an ellipse.

Figure2.3: Cylinder oblique cross-sections



2.2.2. The center of the cylinder and the center of cross-sections at any angle are the same.

Figure 2.4: Cylinder oblique cross-section



2.3. Cylinder and Oblique angle

2.3.1. The oblique angle of the cross-section in the cylinder determines the eccentricity of the ellipse. The cross-section's elongation increases as the slope increases and vice versa.

Figure 2.5: Cylinder 20° oblique cross-section

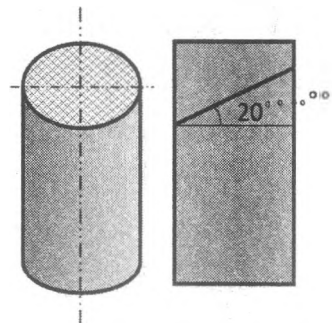


Figure 2.6: Cylinder 40° oblique cross section

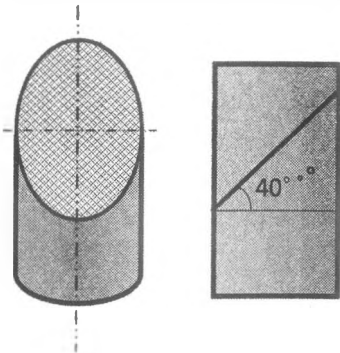
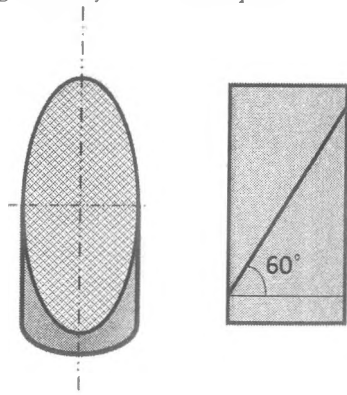
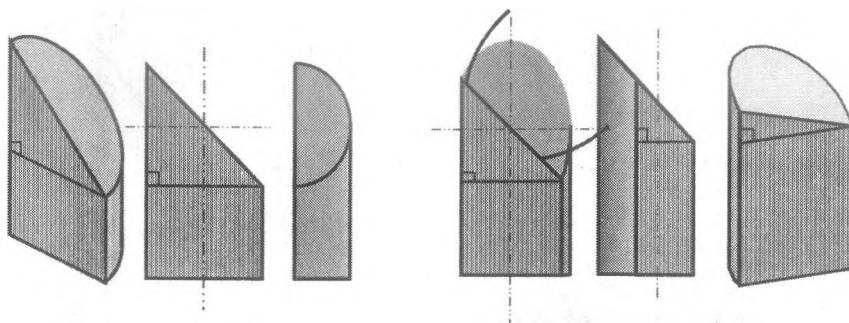


Figure 2.7: Cylinder 60° oblique cross section



2.3.2. The longitudinal cross-section at any angle forms a right triangle

Figure 2.8: longitudinal cross sections



2.4. Relation between Cylinder, Ellipse and Circle

1. An ellipse is a precise reformation of a circle.
2. The elongation (eccentricity) of an ellipse is determined by its inclination.
3. The outer surface of the cylinder is the boundary of the ellipse seen in the cylinder.

From the reasons stated above, it is easy to find all the dimensions of the ellipse found in the cross-section of a cylinder with the aid of existing circle and trigonometric calculations.

2.5. Proof for New Method

A wooden cylinder was cut at a 60° angle to demonstrate this new method and its oblique cross-section was an ellipse. Also, the obliquely-cut cylinder was cut longitudinally into several pieces and its dimensions were observed and calculated. In this study, it was confirmed that the inclination angle plays an important role in determining all dimensions of an ellipse, including its eccentricity.

Figure2.9: obliquely-cut cylinder

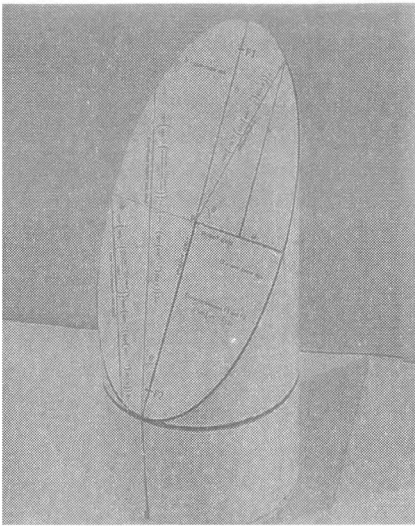
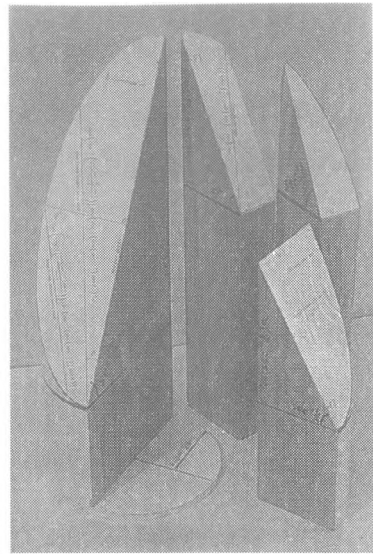


Figure2.10: longitudinal cross sections



3. Ellipse Formulas

3.1. Inclination angle and eccentricity

Inclination angle is calculated by the ratio of the major axis and the minor axis.

Inclination angle

$$= \sec^{-1} \frac{\text{major axis}}{\text{minor axis}}$$

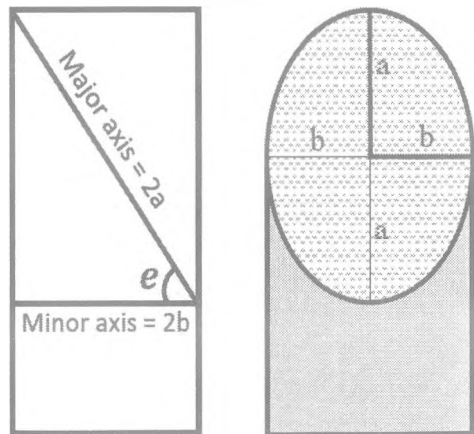
$$= \sec^{-1} \frac{a}{b}$$

,

Inclination angle denoted as eccentricity

$$\therefore \text{Eccentricity } e = \sec^{-1} \frac{a}{b}$$

Figure3.1: cylinder oblique cross section



3.2. Foci

According to the new perspective of an ellipse, the distance between the foci is equal to the height of the oblique ellipse.

The elongation angle $\angle DCE = (e)$

in the right triangle $\Delta F'OB$

$$\angle F'BO = \angle DCE = (e),$$

$$\mathbf{OB} = \mathbf{b}$$

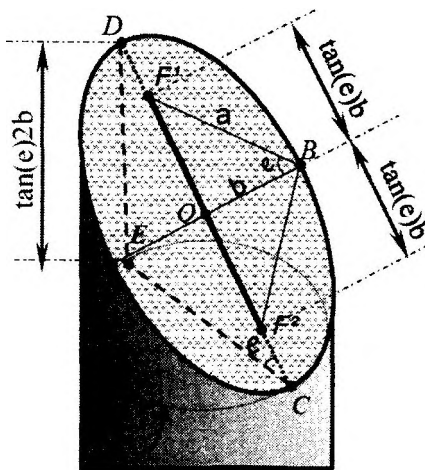
$$\therefore F^1O = \tan(e)b$$

$$F^1F^2 = \tan(e)2b = ED$$

$$\text{Foci} = \tan(e)2b \quad e = \sec^{-1} \frac{a}{b}$$

$$\left[\overline{F^1B} = \overline{F^2B} = \overline{OC} = \overline{OD} = a, \overline{AB} = \overline{CE} = 2b, \angle DCE = \angle OBF^1 \right. \\ \left. = \angle OBF^2 = e \right]$$

Figure3.2: ellipse focal points



Cylinder base circle
Diameter = $2b$

3.3. Latus Rectum

$$\text{Latus Rectum} = \overline{L^1L^2} = \overline{F^1L^2} \times 2$$

$$\overline{OF^1} = \tan(e)b$$

$$\overline{OR} = \tan(e)b \times \cos(e) = \sin(e)b,$$

$$\therefore \overline{RS} = \cos(e)b = \overline{F^1L^2}$$

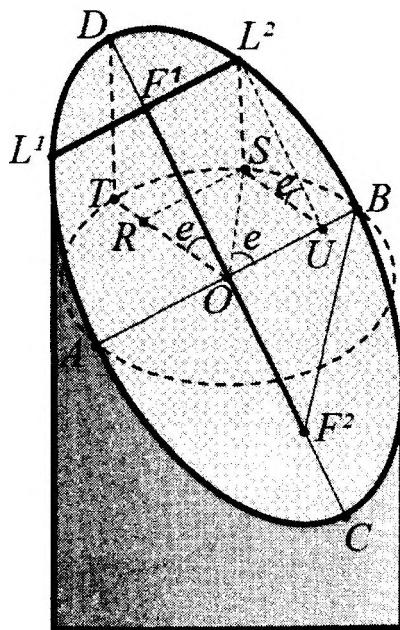
$$\overline{L^1 L^2} = \cos(e)b \times 2 = \cos(e)2b$$

$$\text{Latus Rectum} = \cos(e)2b$$

$$\frac{\overline{F\overline{L}}^2}{\overline{O\overline{D}}} = \overline{R\overline{S}} = \overline{O\overline{U}}, \quad \overline{O\overline{R}} = \overline{S\overline{U}}, \quad \overline{O\overline{F}}^1 = \overline{L}^2\overline{U}, \quad \angle F^1\overline{O\overline{R}} = \angle L^2\overline{U\overline{S}} = \angle S\overline{O\overline{U}} = e,$$

$$\overline{OS} = \overline{OT} = b, \quad e = \sec^{-1} \frac{a}{b}]$$

Figure3.3: ellipse latus rectum



3.4. Radii of an Ellipse (Radius angle $\angle ROB = \theta$, OR = ?)

Radii of an Ellipse

Length of the radius

$$OR = \sec(\angle ROS) \times OS \quad \angle ROS = \sin^{-1}\left(\frac{PU}{b}\right),$$

$$PU = \sin(e) \times PT, \quad PT = \sin(\theta) \times b$$

$$\therefore PU = \sin(e) \times \sin(\theta) \times b$$

$$\angle ROS = \sin^{-1}\left(\frac{\sin(e) \times \sin(\theta) \times b}{b}\right) = \sin^{-1}(\sin(e) \times \sin(\theta))$$

$$OR = \sec\left(\sin^{-1}(\sin(e) \times \sin(\theta))\right) \times b$$

Ellipse Radius = $\sec(\sin^{-1}(\sin(e)\sin(\theta)))b$
--

Figure 3.4: ellipse radius

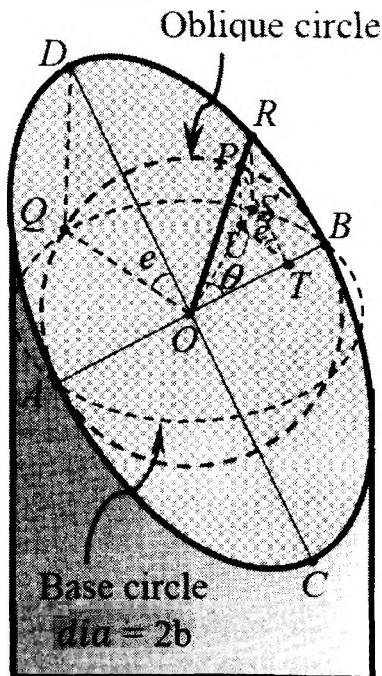
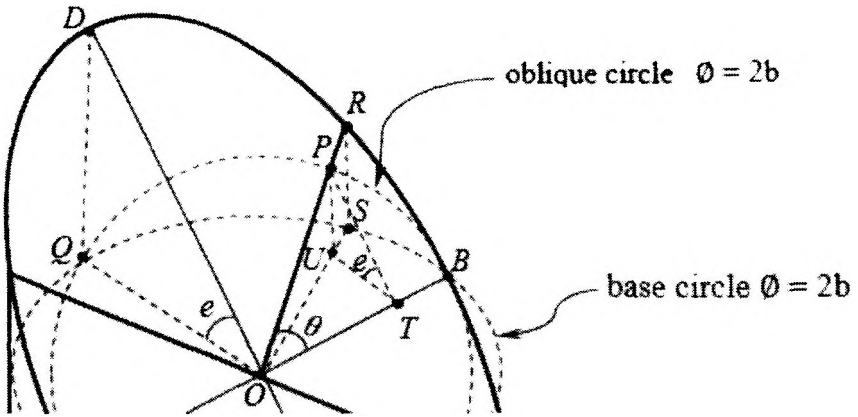


Figure3 5. ellipse radius enlarge view



3.5. Chord length from major axis

(Chord angle $\angle PCD = \theta$, $CP = ?$)

Length of the chord

$$CP = \sec(\angle QCP) \times CQ$$

$$\angle QCP = \sin^{-1}\left(\frac{ZX}{b}\right),$$

$$TU = \sin(e) \times CT$$

$$CT = \cos(\theta) \times b,$$

$$\therefore TU = \sin(e) \times \cos(\theta) \times b$$

$$\begin{aligned} \angle QCP &= \sin^{-1}\left(\frac{\sin(e) \times \cos(\theta) \times b}{b}\right) \\ &= \sin^{-1}(\sin(e) \times \cos(\theta)) \end{aligned}$$

$$CQ = \cos(\angle YCW) \times CE, \quad \angle YCW = \tan^{-1}\left(\frac{YW}{CW}\right)$$

$$YW = \tan(\theta) \times b, \quad CW = \cos(e) \times b,$$

$$\therefore \angle YCW = \tan^{-1} \left(\frac{\tan(\theta) \times b}{\cos(e) \times b} \right)$$

$$CQ = \cos \left(\tan^{-1} \left(\frac{\tan(\theta)}{\cos(e)} \right) \right) \times 2b$$

$$\therefore CP = \sec \left(\sin^{-1} \left(\sin(e) \times \cos(\theta) \right) \right) \cos \left(\tan^{-1} \left(\frac{\tan(\theta)}{\cos(e)} \right) \right) 2b$$

Chord length from major axis = $\sec \left(\sin^{-1} \left(\sin(e) \cos(\theta) \right) \right)$

$$\cos \left(\tan^{-1} \left(\frac{\tan(\theta)}{\cos(e)} \right) \right) 2b$$

Figure 3.6: ellipse chord from major axis

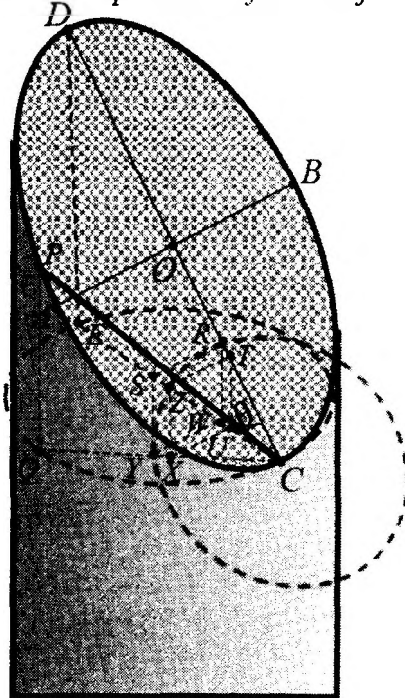
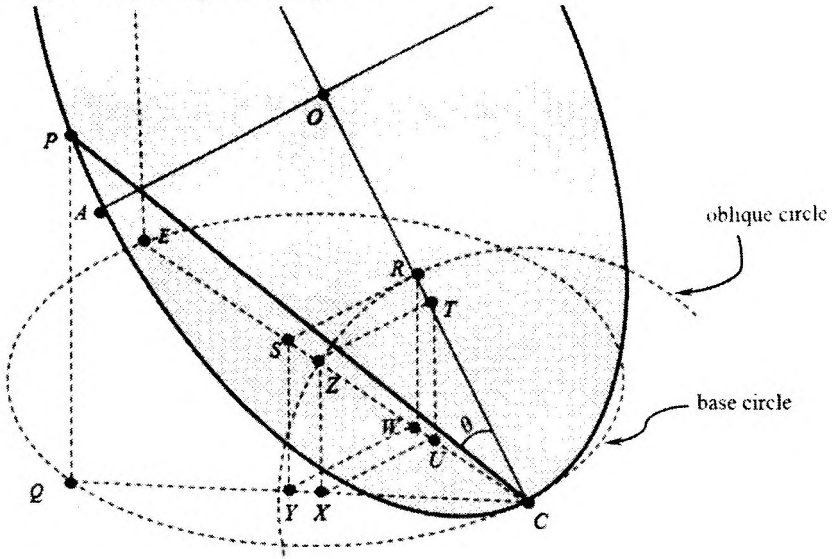


Figure 3.7. ellipse chord from major axis enlarged view



$$\left[\overline{SR} = \overline{YW}, \overline{ZT} = \overline{XU}, \overline{SY} = \overline{RW}, \overline{ZX} = \overline{TU}, \overline{CZ} = \right. \\ \left. \overline{CR} = b, \overline{CE} = 2b, \angle PCD = \theta, \angle DCE = e, e = \sec^{-1} \frac{a}{b} \right]$$

3.6. Chord length from minor axis

(Chord angle $\angle PAB = \theta$, $AP = ?$)

Length of the chord

$$AP = \sec(\angle PAQ) \times AQ$$

$$\angle PAQ = \sin^{-1} \left(\frac{UT}{AU} \right),$$

$$US = \tan(\theta) \times AS$$

$$AU = \cos(\theta) \times 2b,$$

$$UT = \sin(e) \times US,$$

$$AS = \cos(\theta) \times AU,$$

$$\begin{aligned}\therefore UT &= \sin(e) \times \tan(\theta) \times \cos(\theta) \times \cos(\theta) \times 2b \\ &= \sin(e)\cos^2(\theta)\tan(\theta) \times 2b\end{aligned}$$

$$AU = \cos(\theta) \times AB = \cos(\theta) \times 2b$$

$$\begin{aligned}\angle PAQ &= \sin^{-1} \left(\frac{\sin(e)\cos^2(\theta)\tan(\theta) \times 2b}{\cos(\theta) \times 2b} \right) \\ &= \sin^{-1}(\sin(e)\cos(\theta)\tan(\theta)) = \sin^{-1}(\sin(e)\sin(\theta))\end{aligned}$$

$$AQ = \cos(\angle QAV) \times 2b, \angle QAV = \tan^{-1} \left(\frac{TS}{AS} \right),$$

$$TS = \cos(e)US, \quad US = \tan(\theta)AS$$

$$AS = \cos(\theta)AU, AU = \cos(\theta)2b.$$

$$\therefore TS = \cos(e)\tan(\theta)\cos(\theta)\cos(\theta)2b$$

$$\begin{aligned}\angle QAV &= \tan^{-1} \left(\frac{\cos(e)\tan(\theta)\cos(\theta)\cos(\theta)2b}{\cos(\theta)\cos(\theta)2b} \right) \\ &= \tan^{-1}(\tan(\theta)\cos(e))\end{aligned}$$

$$AP = \sec \left(\sin^{-1}(\sin(e)\sin(\theta)) \right)$$

$$\cos \left(\tan^{-1}(\tan(\theta)\cos(e)) \right) 2b$$

Chord length from minor axis
$= \sec \left(\sin^{-1}(\sin(e)\sin(\theta)) \right) \cos \left(\tan^{-1}(\tan(\theta)\cos(e)) \right) 2b$

$$\left[\overline{OD} = a, \quad \overline{AB} = 2b, \quad \angle PAB = \theta, \quad \angle PVQ = \angle UST = e \quad e = \sec^{-1} \frac{a}{b} \right]$$

(Chord distance from center OR = x , TU = ?)

$$\overline{TR} = \sec \angle TRS \times \overline{SR}$$

$$\angle \text{SOR} = \cos^{-1} \left(\frac{OR}{OS} \right) = \cos^{-1} \left(\frac{x}{b} \right)$$

$$\overline{\text{SR}} = \sin\left(\cos^{-1}\left(\frac{x}{b}\right)\right) \times b$$

$$\overline{\text{TR}} = \sec(e) \times \sin\left(\cos^{-1}\left(\frac{x}{b}\right)\right) b$$

$$\overline{\text{TU}} = \sec(e) \sin\left(\cos^{-1}\left(\frac{x}{b}\right)\right) 2b$$

$$\text{axis} = \sec(e) \sin\left(\cos^{-1}\left(\frac{x}{b}\right)\right) 2b$$

$$[\overline{OR} = x, \overline{OD} = a, \overline{AB} = 2b, \angle DOE = \angle TRS = e]$$

$$\overline{VT} = \cos \left(\sin^{-1} \left(\frac{\cos(e) y}{b} \right) \right) \times b$$

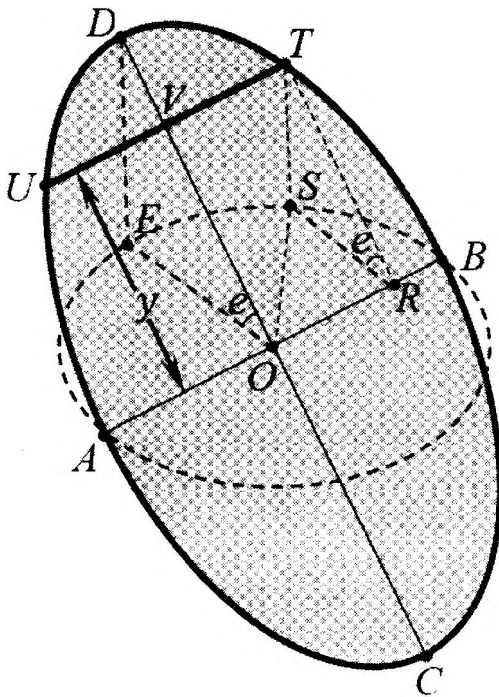
$$\therefore \overline{UT} = \cos \left(\sin^{-1} \left(\frac{\cos(e) y}{b} \right) \right) 2b$$

Chord length parallel to minor

$$\text{axis} = \cos \left(\sin^{-1} \left(\frac{\cos(e) y}{b} \right) \right) 2b$$

$$[\overline{OV} = y, \overline{OD} = a, \overline{AB} = 2b, \angle DOE = \angle TRS = e]$$

Figure3.10: chord parallel to minor axis



3.9. Distance between tangent points

$$(OU = l, TV = ?)$$

Distance between

$$TV = \sec(\angle TRS) \times RS \times 2$$

$$RS = \sin(\angle SOR) \times OS, \quad \angle SOR = \sec^{-1}\left(\frac{OU}{OS}\right)$$

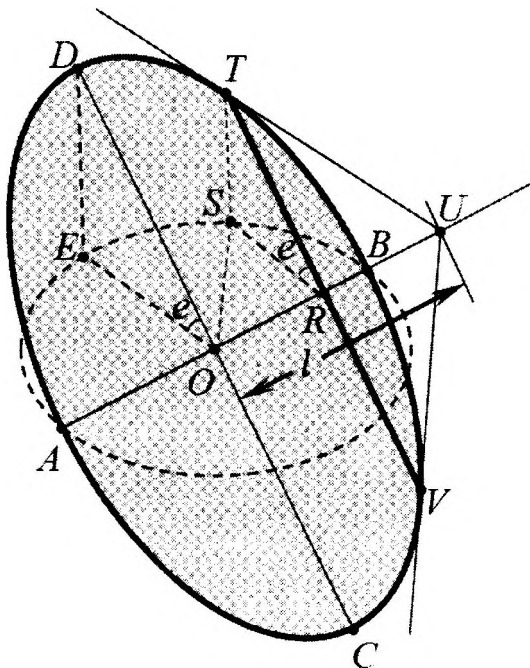
$$TV = \sec\left(\sec^{-1}\frac{a}{b}\right) \times \sin\left(\sec^{-1}\left(\frac{l}{b}\right)\right) \times b \times 2$$

$$= \frac{a}{b} \times \sin\left(\sec^{-1}\left(\frac{l}{b}\right)\right) \times b \times 2 \quad \therefore TV = \sin\left(\sec^{-1}\left(\frac{l}{b}\right)\right) 2a$$

$$\text{Distance between tangent points} = \sin\left(\sec^{-1}\left(\frac{l}{b}\right)\right) 2a$$

$$[\overline{OU} = l, \overline{OD} = a, \overline{AB} = 2b, \angle DOE = \angle TRS = e]$$

Figure3.11: Distance between tangent points



4. Perimeter

Circumference of the ellipse is the distance around the edge of the oblique cross-section. The straightened outer surface of the obliquely cut cylinder is a pure sine curve line. There is already calculus formula for finding the length of a sine curve line. This existing formula can be used to find the circumference of an ellipse.

Figure4.1: oblique cut cylinder

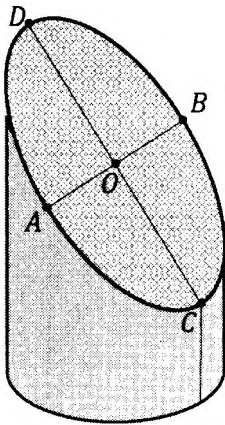
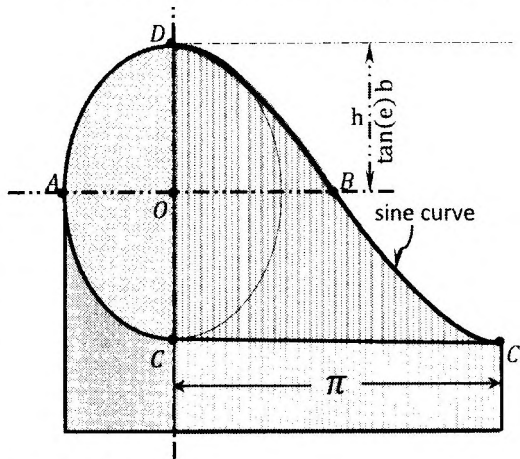


Figure4.2: cylinder outer surface straighten view



Sine curve; period 2π , amplitude 'h',

$$\text{Sine curve length} = \int_0^{2\pi} \sqrt{1 + (g'(x))^2} dx,$$

$$g(x) = h \cos(x) \{0 < x < 2\pi\}$$

Source:

https://www.desmos.com/calculator/gtyisemgxj?fbclid=IwAR0TyjBvls5jc_Aj7U5dXAZ2LnEkISNZg0GD SqJDyIE8ZDr0LJ6emOdzfIU

(Courtesy: Jeremy Galvagni, The Bement School, Massachusetts)

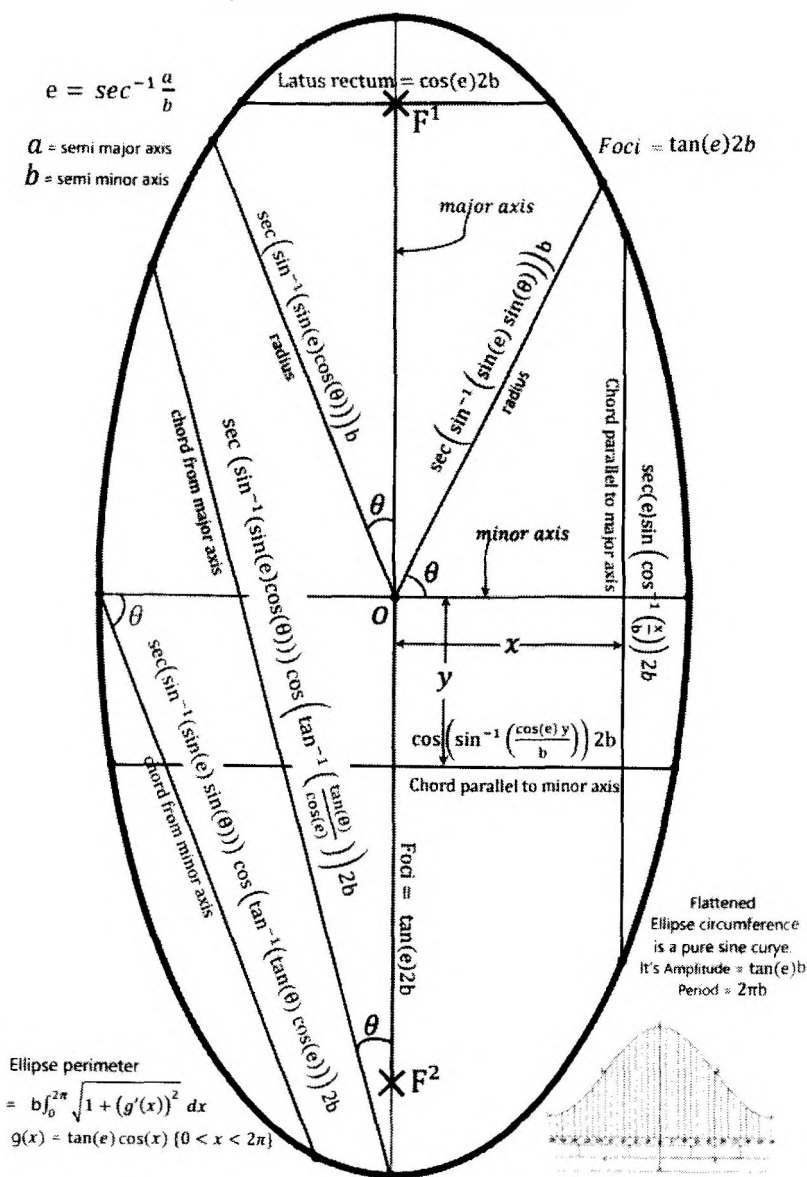
$$\therefore \text{The Perimeter of an ellipse is} = b \int_0^{2\pi} \sqrt{1 + (g'(x))^2} dx$$

$$g(x) = \tan(e) \cos(x) \{0 < x < 2\pi\}$$

[period = $2\pi b$, $h = \tan(e)b$, b = semi minor axis, $e = \sec^{-1} \frac{a}{b}$]

5. Formula Template

Ellipse Formulas – Paul's method



6. Conclusion

Although an ellipse is a 2d shape on a plane, its dimensions can easily be calculated by considering it as the oblique cross-section of a cylinder. A knowledge of trigonometry is necessary for developing formulas in this manner. The formulas described above are just a few examples. Apart from these, it can be made in many other ways. This method is easy to understand and easy to solve application problems of ellipses.

Additional:

The formulas mentioned here can also be used

$$e = \cos^{-1} \frac{b}{a} = \sec^{-1} \frac{a}{b}$$

$$\text{Foci} = \sin(e)2a = \tan(e)2b$$

$$\text{Latus rectum} = \cos^2(e)2a = \cos(e)2b$$

$$\begin{aligned} \text{Ellipse radii} &= \cos(\tan^{-1}(\tan(e) \sin(\theta))) a \\ &= \sec(\sin^{-1}(\sin(e) \sin(\theta))) b \end{aligned}$$

$$\begin{aligned} \text{Chord parallel to minor axis} &= \cos(e) \cos\left(\sin^{-1}\left(\frac{y}{a}\right)\right) 2a \\ &= \cos\left(\sin^{-1}\left(\frac{\cos(e)y}{b}\right)\right) 2b \end{aligned}$$

$$\begin{aligned} \text{Chord parallel to major axis} &= \cos\left(\sin^{-1}(\sec(e))\left(\frac{x}{a}\right)\right) 2a \\ &= \sec(e) \sin\left(\cos^{-1}\left(\frac{x}{b}\right)\right) 2b \end{aligned}$$

Chord from major axis

$$\begin{aligned} &= \cos(\tan^{-1}(\tan(e) \sin \theta)) \cos(\tan^{-1}(\sec(e) \tan \theta)) 2a \\ &= \sec\left(\sin^{-1}(\sin(e) \times \cos(\theta))\right) \cos\left(\tan^{-1}\left(\frac{\tan(\theta)}{\cos(e)}\right)\right) 2b \end{aligned}$$

Chord from minor axis

$$\begin{aligned} &= \\ &\cos(\tan^{-1}(\tan(e) \cos \theta)) \sin\left(\cot^{-1}\left(\frac{\tan \theta}{\sec(e)}\right)\right) 2a \end{aligned}$$

$$\begin{aligned} &= \\ &\sec(\sin^{-1}(\sin(e) \sin(\theta))) \cos\left(\tan^{-1}(\tan(\theta) \cos(e))\right) 2b \end{aligned}$$

THE STORY OF THE FIFTH POSTULATE OF EUCLID

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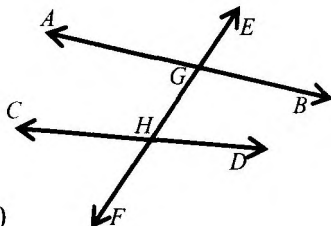
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Euclid (BC 330-BC 275) was a native of Athens. Ptolomy invited him to Alexandria in BC 306. There he worked as a teacher in the University for 31 years till the end of his life. He was so dedicated and devoted that he was respected as a saint.

Euclid's best contribution to Mathematics is 'The Elements.' No other book except Bible has been so widely translated and circulated. He worked in the Museum and Library of Alexandria. He made order for the classical geometry.

The five Postulates

1. Two distinct points determine one and only one line.
2. A line can be extended indefinitely in both directions.
3. A circle can be drawn, a given point as centre with a given radius.
4. All right angles are equal.
5. If a transversal cuts two straight lines such that the sum of two interior angles on one side of the transversal is less than 180, the two lines will intersect if produced in that direction.



$$\angle BGH + \angle DGH < 180$$

\Rightarrow Ray GB and Ray HD will intersect.

The first four postulates mentioned are self evident fundamental concepts.

The Story : Many mathematicians including Euclid were of the opinion that the 5th is not really a postulate but a theorem which is to be proved. Till the first half of the 19th century, many attempts were made to prove the 5th postulate.

Some of the well known attempts are given below.

Proclus (CE410-485) wrote about many such attempts.

Persian poet and astronomer Omar Khayyam tried to prove the theorem.

Giordano Vitale (1633-1711) of Germany.

Girolamo Saccheri (1677-1733) of Italy.

Johann Lambert (1728-1777) of Germany.

Three mathematicians of 19th century showed that the 5th postulate cannot be proved.

Janos Bolyai (1802-1860) of Hungary was one of them. His article was sent to Carl Friedrich Gauss (1777-1855) of Germany. Gauss wrote to Bolyai that he had already found out what Bolyai had said about the 5th postulate. Gauss did not publish his discovery.

Nikolai Lobachevsky, a Russian mathematician (1792-1855) published a paper on the 5th postulate. He found that the 5th postulate cannot be proved.

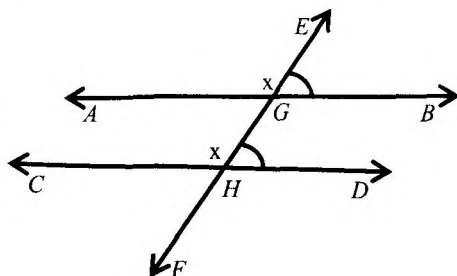
By assuming that more than one line can be drawn parallel to a given line through an external point, a logically consistent geometry can be developed. That geometry is known as Hyperbolic Geometry.

Later George Friedrich Riemann of Germany (1826-1866) published another geometry in 1855, in which there is no parallel line to a line.

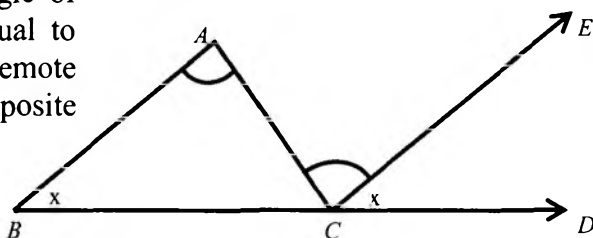
Lobachevsky published this paper in 1829 in Russian language.
Thus flows the river of interesting and wonderful history of the 5th postulate.

The following are the derivatives of the 5th postulate.

- (1) If two parallel lines are cut by a transversal, corresponding angles are equal, alternate angles are equal, co-interior angles are supplementary.



- (2) The exterior angle of a triangle is equal to the sum of the remote interior opposite angles.



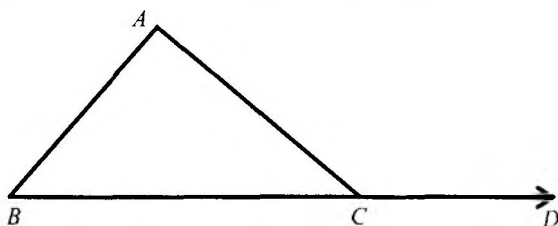
Ray CE is parallel to line BA.

$\angle BAC = \angle ACE$ (Alternate angles)

$\angle ABC = \angle ECD$ (Corresponding angles)

So $\angle ACE + \angle ECD = \angle ACD = \angle BAC + \angle ABC$

Sum of the 3 interior angles of a triangle, is 180.



$$\angle A + \angle B + \angle ACB = \angle ACD + \angle ACB = 180$$

Proved using the exterior angle theorem.

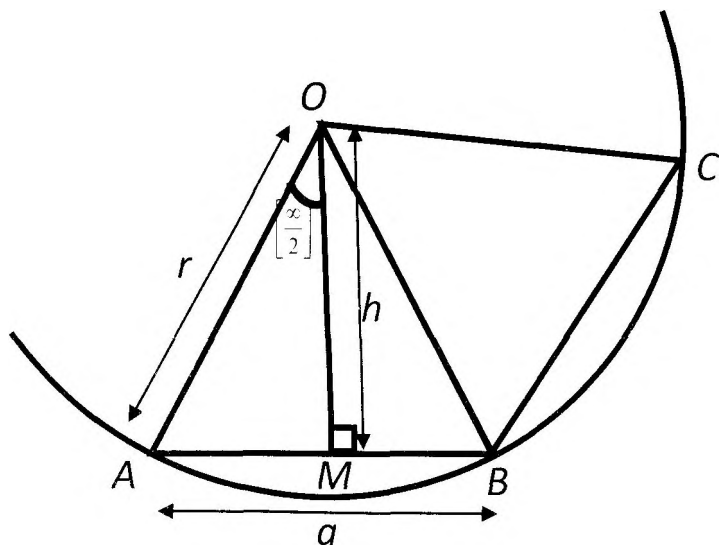
CHANGE THE CONDITIONS AND

Mr. Meghraj J Bhatt

(e-mail : mjbhatt9@yahoo.com)

One of the aims to teach Mathematics at +2 level is to develop the ability to apply the knowledge in different situations. A teacher can create situations in the class room while teaching in which the students have to apply their knowledge by giving problems with some modified conditions than those given in the texts. Here is an example for that.

Problem : To find the area of a regular polygon inscribed in a circle.



We will refer to the figure given and also to the notations given below.

An arc of a circle with center ' O ' and two triangles of the inscribed polygon are shown.

a = length of one side of the regular n -gon.

r = radius of the circumcircle
 h = length of the perpendicular
 α = angle subtended at the center of the circle by a side of the n -gon.

The problem is to find the area of the regular n -gon given **anyone** of the following sets :

- | | | |
|---------------------|---------------------|---------------------|
| 1. a and h | 2. a and r | 3. h and r |
| 4. h and α | 5. r and α | 6. a and α |

To start with , the student should think of a construction to join the vertices of the triangle to the center of the circle. After doing this the student will understand that the problem is reduced to finding the area of a single triangle and then to multiply it by ' n '.

The solution under set (1) is simple and the student will be able to do it as he knows that

The area of a triangle

$$= \frac{1}{2} \times \text{base} \times \text{altitude}.$$

$$= \frac{1}{2} ah . \text{ and } \therefore \text{ the area of the } n\text{-gon} = \frac{1}{2} ahn. \dots (1)$$

Now , the role of the teacher should be changed. He should ask the class to find the formula under the given sets of conditions (2) to (6).

Condition : 2 . Given a and r : The student has to think to find the value of ' h ' in terms of ' a ' and ' r '. For that he has to understand and decide that the point M is the mid-point of AB . Hence

$$AM = \frac{1}{2} a.$$

Then he has to calculate $h = OM$ by applying Pythagoras theorem to the triangle AMO .

$$\text{i.e. } OM = \sqrt{r^2 - \frac{a^2}{4}} = \frac{1}{2} \sqrt{4r^2 - a^2}$$

$$\begin{aligned} \therefore \text{Area of } \triangle AOB &= \frac{1}{2} a \frac{1}{2} \sqrt{4r^2 - a^2} \\ &= \frac{a}{4} \sqrt{4r^2 - a^2} \end{aligned}$$

$$\text{And hence area of the } n\text{-gon} = \frac{na}{4} \sqrt{4r^2 - a^2} \dots\dots\dots(2)$$

After this much work done in the class under the guided supervision of the teacher , the students may be asked to complete the work by finding the formulas for the remaining four conditions.

Similarly , the teachers can find such other situations / problems where such type of self exploration work can be assigned and provide opportunities to the students to apply their knowledge in changed conditions.

MATHEMATICS NEWS

By: Dr. Devbhadra V. Shah, Associate Professor, Dept. of Mathematics, Veer Narmad South Gujarat University, Surat, Gujarat, drdvshah@yahoo.com

India bags 9th place in International Mathematical Olympiad 2023; grabs 8 medals

A six-member team representing India has secured six medals – two gold, two silver and two bronze – at the 64th International Mathematical Olympiad (IMO 2023) held at Chiba, Japan, from July 2 - 13, 2023. The team finished ninth among the 112 countries that participated in the competition.



Atul Shataavart Nadig and Arjun Gupta with 37 points each won the gold medal. Ananda Bhaduri and Siddharth Choppara won the silver medal with 29 points each, while Adhitya Mangudy, and Archit Manas won the bronze with 22 and 20 points, respectively.

This is the fourth time that the Indian team has secured a position in the top 10. India had finished 7th in 1998 and in 2001, and 9th in 2002. In 2001 and 2012, India got two gold medals at the IMO.

The Homi Bhabha Centre for Science Education (HBCSE)-TIFR is the nodal centre for training and selecting students for the international Olympiads. The final team is selected through various stages of the National Olympiad Examination conducted by HBCSE.

Source: <https://news.careers360.com/india-bags-9th-place-in-international-mathematical-olympiad-2023-grabs-8-medals>

US teens say they have new proof for 2,000-year-old Pythagorean theorem



Two high school students *Calcea Johnson* and *Ne'Kiya Jackson* from New Orleans (located in the southeastern region of the U.S. state of Louisiana) are making major waves in the world of academia after solving a

mathematical equation involving the Pythagorean Theorem that has stumped mathematicians for the last 2,000 years. They found a new way to prove the Pythagorean Theorem using trigonometry without circular logic.

According to their presentation, they noted that even the most notable mathematicians had thought that solving the Pythagorean Theorem without using circular logic was impossible. There are no trigonometric proofs, because all the fundamental formulae of trigonometry are themselves based upon the truth of the Pythagorean Theorem. Yet they knew that was not true, and they proved it.

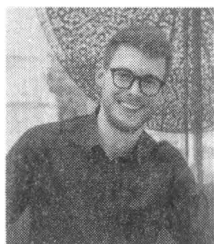
They present a new proof of Pythagoras' Theorem which is based on a fundamental result in trigonometry - the Law of Sines - and the proof is independent of the identity $\sin^2 x + \cos^2 x = 1$. In short,

they could prove the theorem using trigonometry and without resorting to circular reasoning.

Source: 1. <https://theblackwallsttimes.com/2023/03/28/new-orleans-teens-solve-impossible-mathematical-equation/>

2. <https://www.theguardian.com/us-news/2023/mar/24/new-orleans-pythagoras-theorem-trigonometry-prove>

First year graduate student finds paradoxical set



Cédric Pilatte, a first-year graduate student of Oxford University proved that it is possible to create a set, named as Sidon set, that satisfies two seemingly mismatched properties:

(a) No two pairs of numbers in the set add up to the same total. For example, add together any two numbers in 1, 3, 5, 11 and you will always get a unique number. It is easy to construct small “Sidon” sets like this one, but as the number of elements increases, so too does the likelihood that the sums will coincide, destroying the Sidon-ness of the set.

(b) The set must be very large. It must be infinite, and you should be able to generate any sufficiently large number by adding together at most three numbers in the set.

Mathematicians were delighted when they came to know that such seemingly impossible things exist.

The question of whether such a set exists was unsolved for decades, ever since it was posed by the prolific Hungarian mathematician *Paul Erdős* and two collaborators in 1993. Erdős’ fascination with Sidon sets can be traced to a conversation he had in 1932 with their inventor *Simon Sidon*, who at the time was

interested in understanding the growth rate of these sets. Erdős realized early on that Sidon sets are extremely hard to scale.

Sidon sets arise in a variety of mathematical contexts including number theory, combinatorics, harmonic analysis and cryptography, but the simple question of how big they can get has been a lasting mystery that Erdős considered for much of his career.

Source: <https://www.quantamagazine.org/first-year-graduate-finds-paradoxical-number-set-20230605/#:~:text=Such%20is%20the%20case%20with,satisfies%20two%20apparently%20incompatible%20properties.>

Computer scientists prove decades old problem of size of a set of integers

For decades, mathematicians have been inching forward on a problem about which sets contain evenly spaced patterns of three numbers. Now two computer scientists have passed all these achievements.



Zander Kelley (left), a graduate student at the University of Illinois, Urbana-Champaign and *Raghu Meka* (right) of the University of California, Los Angeles,

both computer scientists, had found a new - and lower limit on the size of a set of integers in which no three of them are evenly spaced (ruling out combinations like 3, 8 and 13 or 101, 201 and 301). Their claim shattered the previous record, attained in 2020.

The evenly spaced sequences of numbers Kelley and Meka wanted to avoid were arithmetic progressions (A.P.). They focused on progressions made up of just three numbers, following a line of research from a 1936 paper by *Paul Erdős* and *Paul Turán*. In

1936, Erdős and Turán published a paper that sparked nearly a century of research into the size of integer sets that avoid A.P. Erdős and Turán wanted to know how many numbers smaller than some upper limit N can be put into a set without creating any three-term A.P. N might be 1,000, 1 million, or some unimaginably huge number. They guessed that as N grew larger, a set without three-term progressions would have to become extremely thin.

In 1946, *Felix Behrend* found a way to construct sets of numbers between 1 and N without producing any three-term progressions. His method resulted in sets that got bigger as N did, but extremely slowly. When N is 1,00,000, Behrend's set contains just 171 elements. When N is 1 million, his set has 586 numbers - less than 0.06% of the numbers between 1 and 1 million. Until Kelley and Meka's paper arrived, the maximum size of a progression-free set was restricted from below by Behrend's formula. Together with Kelley, Meka found a new smaller upper bound to the size of progression-free sets.

Source: <https://www.quantamagazine.org/surprise-computer-science-proof-stuns-mathematicians-20230321/>

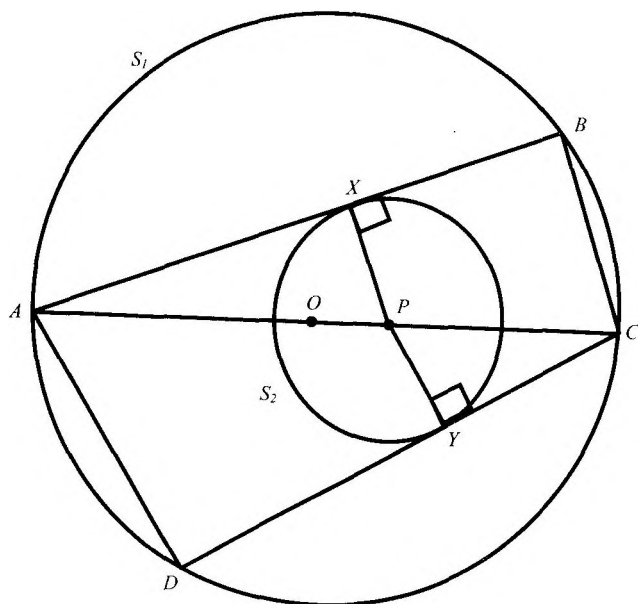
PROBLEM SECTION

Dear Readers,

Here , I am posing two Problems – one on Algebra and the other on Geometry. I request all the Teachers to try to solve them. If somebody feels that some of your students can solve it , give them. If somebody solves, check and then send to me. We will publish in the student's name. Name of all teachers giving correct answer also will be published in the next issue. Please send the answers directly to me on : mjbhatt9@yahoo.com ----- Editor.

Q.1. If $a^2 + b^2 + c^2 + d^2 - ab - bc - cd + \frac{2}{5} = d$, then find the value of $a + b + c + d$, where a , b , c , d are real numbers.

Q.2. Circle S_1 with center O and diameter AC is given.



P is a point on OC .

Taking P as center and radius less than PC , another circle S_2 is drawn.

Tangents are drawn to S_2 from A and C which intersect the circle S_1 at B and D respectively.

B and D are on the opposite sides of line AC .

If $AD = a$, $BC = b$ and $OP = c$, find the radius of S_1 in terms of a , b , c .

ASSOCIATION ACTIVITY

Minutes of the Executive Committee Meeting held on 09.04.2022

A meeting of the AMTI Executive committee was held on 09.04.2022 at 5 p.m. via Zoom.

Nine members were present and two members gave concurrence over phone.

Sri R. Athmaraman, our patron, presided over the meeting. The following members were present:

- | | |
|------------------------------|------------------------|
| 1. Sri M. Mahadevam | 2. Dr. M. Palanivasan |
| 3. Dr. S.R. Santhanam | 4. Sri R. Athmaraman |
| 5. Dr. Hemalatha Thyagarajan | 6. Dr. S. Muralidharan |
| 7. Dr. G.P. Youvaraj | 8. Dr. R. Shanthi |
| 9. Dr. M. Kumaraswamy | 10. Sri V. Seshan |
| 11. Sri. P. Ramesh | |

1. Dr. M. Palanivasan, General Secretary, welcomed the members. The following points of the Agenda were discussed.

2. NMTC-53:

Dr. R. Shanthi, Talent Exam. Secretary, presented a detailed report on NMTC-53. The first level exam was held on 12-02-2022 through online. Because of a technical error, a good number of students were not able to upload their answer sheets. So we decided to ignore the first level exam and allow **all** the registered students to write the second level exam through offline mode on 12.3.2022 from 2.00 p.m. to 5.00 p.m. Out of 8963 students registered, 5274 students wrote the second level exam. We have allotted 34 open Quota centers. The second level tests were smoothly conducted. Dr. Hemalatha Thyagarajan raised a few queries about the question papers. Dr. S.R. Santhanam gave detailed explanation.

3. Annual Conference:

Dr. S.R. Santhanam, Conference Secretary, informed that there are two offers for host-ship from Manipal and Goa. The

General Secretary and the Conference Secretary will visit both the places and decide the venue for our conference.

4. General body meeting

It has been decided to conduct our next General Body meeting, via zoom, before September 2022.

5. Audited Annual Account 2020 - 21 for scrutiny:

Since The Treasurer was not available, the General Secretary submitted the report. Sri M Mahadevan and Dr. Hemalatha Thyagarajan sought a few clarifications regarding some items and they were explained in the meeting.

Non-submission of annual records to the Registrar for a very long period, (more than two decades) was a problem AMTI was facing; now all the necessary documents have been submitted for the period 1990-1991 to 2018-2019 to the Registrar of Societies. With the help of a well-wisher, a special Government Order has been obtained regularizing our registration without break and with the *same* registration number.

The Executive Committee approved the expenditure of a total amount of Rs. 12,37,400/- (Twelve lakhs thirty seven thousand four hundred only) which includes the penalty amount paid to the Registrar of Societies. Also it has been decided that hereafter no such irregularities should happen on any account, in future.

6. Status report

a. The Mathematics Teacher:

Mathematics Teacher volume 55 (1&2) and (3&4) have been sent to the members. Volume of 56 (1,2,3,4) is to be printed. We have received Rs. 1,00,000/- grant from DST for the year 2021.

b. Junior Mathematician:

Junior Mathematician volume 29 (3), 30(1), 30(2) have been sent to the members. Volume 30(3), 31(1), 31(2), 31(3) are to be printed.

- c. NMTC:
Because of the bitter experiences with the online examination, it has been decided to conduct NMTC-54 through offline mode and also to avoid the Open Quota.
 - d. Workshop:
Because of Covid problem, the school annual exams are going to be held during May 2022. So there is no possibility of conducting summer workshop this year.
 - e. Popular lecture:
Dr. M. Kumaraswamy, Secretary for Popular lectures, has assured to conduct at least one lecture for every couple of months.
7. Under Any other matter:
The General Secretary informed that because of Covid there was no income for our AMTI for the past 2 years. Sri M. Mahadevan and Dr. Hemalatha Thyagarajan have suggested to combine the issues of The Mathematics Teacher and The Junior Mathematician and print limited copies only. For others we can send the copies in PDF form.
8. Vote of thanks:
The General Secretary proposed Vote of thanks.

(Dr. M.PALANIVASAN)
General Secretary, AMTI

Minutes of General Body Meeting

Minutes of General Body Meeting of AMTI held on 25.06.2022 at 4 p.m. via zoom; 30 members were present.

The meeting commenced with prayer by Mr. S.R. Santhanam.

Our President Prof. I.K. Rana presided over the meeting and welcomed the gathering.

Minutes of the last General Body meeting was read by General Secretary Dr. M. Palanivasan with compliance report or inability to take some steps due to covid-19. It was adopted unanimously.

In the absence of treasurer, Audited accounts for the year 2020-21 were presented by the General Secretary. After perusal by the members, Sri S.R. Santhanam raised queries in particular about the huge amount that goes to the staff salary annually, in spite of nil income for AMTI for the past two and a half years. It was suggested to minimize the expenses in this item. This was accepted and the audited accounts were adopted unanimously.

Dr. Hemalatha suggested to conduct online classes to improve the income for our Association Dr. S.R. Santhanam also advocated the same. Prof. I.K. Rana offered voluntarily that AMTI can use his website at free of cost to conduct online classes. It was decided unanimously to form a committee for AMTI online classes. The following members were chosen, with their concurrence, for the “AMTI Online Classes” committee, to offer suggestions and recommendations.

- | | |
|------------------------|-----------------------|
| 1. Mrs. Usha Venkatesh | 2. Mrs. K. Maheshwari |
| 3. Mr. R. Seetharaman | 4. Mr. Ajay Kumar and |
| 5. Mr. P. Ramesh | |

Dr Shanthy, Secretary for Talent Contests presented the NMTC-53 report. The Preliminary test was conducted on 12.02.2022 through online. Because of the website problem, the first level results could

not be fully assessed/declared. With a view that no student should be affected because of the technical problem, all the participants were allowed to appear in the final test on 12.03.2022. The results have been declared.

The Mathematics Teacher vol. 56 (1 and 2) and (3 and 4) are ready for print. Junior Mathematician Vol. 30(3) and 31(1), 31(2), and 31(3) are ready to get printed. Mrs. Lakshmi suggested to send the digital copy of The Mathematics Teacher and Junior Mathematician to those who prefer the same. Our General Secretary accepted and ready to send through e-mail for the members who opt for the same.

Dr. S.R. Santhanam, Conference Secretary, informed that this year's Annual conference is to be held at Manipal, Karnataka, as anticipated, during December. Mr. Seetharaman suggested to conduct next year's conference at Sairam Group of Institutions, Chennai and he agreed to do everything needed for the same.

Mr. Lakshmi Narayanan raised some queries and it was cleared by our General Secretary.

Our President suggested to publish in AMTI's website, the list of members of the EC, along with the list of office bearers.

Mr. Megaraj Bhat has accepted to be the Editor of The Mathematics Teacher. Dr Kovi Palani has agreed to be the editor of Junior Mathematician and he will be provided with an Associate/Assistant Editor in due course.

Our General Secretary proposed vote of thanks.

(Dr. M.PALANIVASAN)
General Secretary, AMTI

Minutes of General Body Meeting

Minutes of General Body Meeting of AMTI held on 29.12.2022 at 4:00 p.m. in the 55th Conference venue at Madhava Kripa School, Manipal, Karnataka.

The meeting commenced with prayer by Mrs. R. Padmavathy.

In the absence of our President Prof. I.K. Rana, our Patron Mr. R. Athmaraman presided over the meeting and welcome the gathering.

Audited accounts for the year 2021-2022 were presented by the General Secretary. After perusal by the members Dr. S.R Santhanam and Mr. Lakshmi Narayanan raised queries about the huge amount that goes to the staff salary and requested to minimize in this item and suggested that one staff is enough for our office at Triplicane. Our treasurer raised some queries about the transaction of funds in society of registration matter. General Secretary explained clearly that the registration matter was submitted in the Executive Committee meeting held on 9.4.2022 and the Executive Committee approved the total expenditure in this matter. Also General Secretary explained that the entire money was spent under the instruction of our Parton Sri R. Athmaraman. Our Patron explained the pain he took in this matter. Since the Treasurer didnt attend some meetings and didnt visit to our office for a long period, he requested the treasurer to visit our AMTI office and verify the accounts periodically. The auditor accounts were adopted unanimously.

Since our NMTC Secretary was absent, our General Secretary submitted the status report of NMTC-54. The Preliminary Test was conducted on 15.10.2022 through offline. Final examination will be held on 07.01.2023.

Also it has been decided to conduct NMTC-55 through offline. Call notice will be sent on June 2023. Preliminary exam will be on October 2023 and the final examination will be on November 2023.

Mathematics Teacher volume 56(1&2) and (3&4) was dispatched to the members.

Also Junior Mathematician volume 29(3) volume 30(1) and volume 30(2) were already dispatched.

Summer workshop will be conducted on May 2023. Popular Lecture Secretary Dr. M. Kumaraswamy accepted to conduct minimum 5 lectures through offline and online simultaneously.

Mr. M. Krishnan from Kerala was elected as an Executive Member it was proposed by Dr. S.R. Santhanam and seconded by Mr. V. Sundaramurthy. Mr. T. Subramaniam from Chennai was elected as an Executive Member it was proposed by Dr. M. Palanivasan and seconded by Mr. P. Ramesh.

Our Conference Secretary Dr. S.R. Santhanam informed that there was a proposal from Virudhunagar, Tamil Nadu for our 56th conference. The general body members has suggested the Conference Secretary and General Secretary to visit the place and decide.

In the any other matter at Mr. R. Athmaraman suggested to finalize the computer purchased already which were not used.

A committee of Dr. M. Kumaraswamy, Dr. T. Subramanian and Mr. P. Ramesh was formed to finalize the computer matter.

Mr. P. Ramesh was elected as the new Workshop Secretary. Mrs. R. Padmavathy proposed and was seconded by Dr. M. Kumarasamy.

Dr. T. Subramanian proposed vote of thanks.

(Dr. M PALANIVASAN)
General Secretary, AMTI

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